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ROYAL GARDENS, KEW.

BULLETIN

OF

MISCELLANEOUS INFORMATION.

No. 23.] NOVEMBER. [1888.

LX.—LAGOS RUBBER.

(*Ficus Vogelii*, Miq.)

The investigation of plants likely to yield the caoutchouc of commerce is being carried out in West Tropical Africa by numerous correspondents of Kew. Possibly in no other part of the world is there such a wide field for investigation of this kind, and in recent years a considerable trade in india-rubber has arisen through the exertions of officials and traders who have given attention to the subject.

A useful summary of information respecting West African rubbers is given by Captain Moloney in the *Forestry of West Africa*, pp. 78–95. At present the chief rubber-yielding plants on the west coast appear to belong to species of *Landolphia*. These are climbing shrubs with stems 4 to 6 inches in diameter near the ground, but dividing above into numerous branches which support themselves on the neighbouring trees. The rubber of the Gold Coast, known in commerce as Accra rubber, is the produce of *Landolphia owariensis*, Beauv. This is probably the best rubber plant in West Africa. The rubber is obtained by cutting off portions of the bark in strips varying in length from 3 to 10 inches. The cuts are made sufficiently deep to reach the latex canals, and soon the crude juice starts out in drops and gathers on the newly-cut surface. The rubber of the *Landolphia* coagulates on exposure to the air and requires no preparation other than rolling it

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up into balls. "A quantity of the milk is first dabbed on the fore arm "of the operator, and being peeled off forms a nucleus of the ball. "This nucleus is applied to one after another of the fresh cuts, and "being turned with a rotary motion the coagulated milk is wound off "like silk from a cocoon. The coagulation takes place so rapidly on "exposure to the air that not only is every particle cleanly removed "from the cuttings, but also a large quantity of semi-coagulated milk "is drawn out from beneath the uncut bark, and during the process a "break in the thread rarely occurs" [Kew Report, 1880, p. 40].

Another method of collecting West African rubber is described as follows: The blacks wipe off the milk with their fingers and smear it on their arms, shoulders, and breasts until a thick covering of rubber is formed. This is peeled off their bodies and cut into small squares, which are then said to be boiled in water. In European markets such rubber appears in more or less agglutinated masses of small cubes. Specimens of such rubber are shown in the Kew Museums under the name of Thimble rubber [*ib.*, p. 39].

The quantity of rubber exported annually from West Africa from British and other possessions is about 30,000 cwt. The value in 1885 was 265,617*l.*

It appears that in some districts, such as the Gaboon, owing to the reckless destruction of rubber vines the trade is becoming less and less every year. In the other districts the trade is gradually increasing. Attention has been specially directed to rubber plants in the colonies of Gold Coast and Lagos, and owing in a great measure to the interest taken in the subject by Captain Moloney, the exports from these British possessions have risen from nothing in the year 1882 to a value in 1885 of 69,911*l.*

There are doubtless other plants in West Africa from which commercial rubber might be obtained. The Mbungu rubber plant is *Landolphia florida*, Bth. This is distributed over the whole of Central Tropical Africa. There are also several species of Ficus, the original genus yielding commercial rubber which deserve to be investigated.

We are glad to find that following the enterprising example of the Governor of the Colony of Lagos, Captain A. C. Moloney, C.M.G., Mr. Alvan Millson, Commissioner of the Western District residing at Badagry, has recently given attention to the preparation of commercial rubbers from the latex of the trees generally known there as "Abba" trees. Mr. Millson previous to taking up his duties at Lagos had served in British Honduras, where he had become acquainted with the preparation of what is known in commerce as Nicaragua or Central American rubber, the produce of *Castilloa elastica*. A contribution on this latter subject from Mr. Millson will be found in the *Kew Bulletin* for the month of December 1887, p. 14.

The investigations undertaken by Mr. Millson in West Africa are described in the following notes which have been communicated to this establishment by the Secretary of State for the Colonies:—

Badagry, 15th April 1888.

In nearly all the native villages in the western district of the Colony of Lagos, and, I believe, throughout the colony and interior, are to be found large spreading trees, which have been planted for shade in the market places, streets, and compounds. These trees are of the fig family, and are called by the natives *Abba*.

I have measured a tree of this species of the age of 13 years, and found its girth, at 3 feet from the ground, to be 6 feet 4 inches, and its

height to the branches 12 feet, while its total height could not be less than 50 or 60 feet, and its foliage area a quarter of an acre. A tree of this size ought to give large quantities of milk if tapped at the right time of the year. Although it was in fruit when I tapped it, and the season being very dry, was in every respect unsuitable, yet the milk exuded in large drops, and flowed for a considerable distance down the trunk. Three quarts of milk were extracted from this tree without injuring it in any way, and I have little doubt that at any time between the months of July and February from four to five gallons could have been obtained with but little trouble. The trees, however, should only be tapped on alternate years, so as to leave time for a fresh growth of bark to replace that which is removed. It is difficult to form an accurate estimate of the per-centage of dry rubber that would be yielded by a gallon of milk, but I have reason to believe from previous experiments on Central American rubber trees (*Castilloa elastica*) of similar richness of milk, that each gallon should give about three pounds of india-rubber. The value of the rubber produced depends largely upon the care with which it is prepared, and I have reason to believe that the milk of this species, at least, of the "Abba" tree, can be made to give an excellent sample.

Should the above facts be established, it becomes evident that plantations of the "Abba" tree would be a highly profitable investment. It is planted by the simple method of cutting off a branch and pushing it into the ground, and on account of the facility and rapidity with which it is raised, the natives used it largely for fence posts. From the trees already in full growth in the bush and towns a considerable export trade could be readily established, and careful planting would develop this trade to almost an unlimited extent.

The rubber gatherer has no need of expensive implements or heavy baggage when he goes into the bush to collect and prepare the milk. He should take half a dozen or more well-cleansed kerosine-oil tins. With these tins, a sharp cutlass, a few yards of strong cotton cloth, and a sieve made of doubled muslin fastened like a jelly bag to a round hoop, he has all that he absolutely requires for his work.

On reaching the tree to be tapped, deep incisions are made on one side only of the stem and branches. The milk, as it flows from the incisions, is directed into the collector's vessel by a small piece of tin which is inserted into the bark so as to serve as a spout.

When the day's work is done, the milk should be mixed with an equal quantity of pure rain water, and strained through the sieve into clean kerosine-oil tins, which have been well scalded so as to remove all traces of grease. The mixture should be left to stand, without being moved or shaken, for 36 hours. The milk will then have risen to the surface, and the water and impurities which have sunk can be drawn away through a small hole near the bottom of the tin, which has been stopped by a plug of wood. As soon as white particles are seen to pass through the hole with the water, the plug should be inserted, and the washed milk poured into the prepared tin, with the cotton-cloth bag inside.

The milk, having been poured into the bag until the tin is half full, should be left with the mouth of the bag well tied, and a square piece of wood lying on the top of it for 12 hours. A bag of sand weighing about 10 pounds may then be put on to the top of the piece of wood for another 12 hours. Quantities of discoloured water will be seen to flow from the perforations in the sides and bottom of the tin during this

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process, and on touching the top of the bag it will be found to offer some resistance to pressure.

A stout tree branch about 20 feet long should now be cut and trimmed, or if palm-leaf "bamboos" are obtainable, six or eight of them can be strongly lashed together. The pole thus obtained should have one end firmly fixed by thrusting it into a hole dug under a strong tree root, and a block of wood having been cut large enough to fit loosely into the tin, so as to rest on the square piece of wood which lies on the top of the bag of rubber, and to project above the mouth of the tin for about a foot; the tin and block should be thrust under the pole at the distance of perhaps a yard from the end which passes under the tree root. A large bag should now be filled with sand, and hung on to the pole. It is evident that the farther this bag is moved up the pole, the greater will be the pressure on the block of wood which acts as the fulcrum of the lever, and consequently upon the bag of rubber milk upon which it rests. Great pressure can be brought to bear by this simple means on the coagulating juice. Indeed, it will be found advisable to have the prepared tins replaced in their wooden case, and to press the milk in them side by side, by placing a flat board from block to block, and allowing the pole to rest upon that rather than directly upon the blocks. Unless some such precautions be taken, the tins will be apt to bulge, and perhaps burst outwards, when full pressure is applied.

The bag of sand should weigh about 100 pounds, and should be hung as near the tin as possible for 12 hours. It should then be moved along the pole gradually until it reaches the end farthest from the tin, where it should be left for two or three days.

On removing the weights and taking the bag out of the tin, which can be done by pressing the sides and lifting slowly, the mouth of the bag may be untied and the rubber removed, by turning the bag inside out. It will not be found to adhere to the cloth in the slightest degree, nor will there be any traces of viscosity in the rubber itself. It will appear as a white semi-elastic mass, which on exposure to the air will gradually turn black, and will gain in elasticity as it dries.

The samples when prepared should not be unnecessarily exposed to the sun, but will not be injured in any way by exposure to rain. They will, if anything, be improved by immersion in water.

The above method was followed when preparing the sample which I forward as Exhibit No. 1. At this season of the year it is difficult to obtain large enough quantities of milk for extensive experiments, and the specimens I am able to show are in consequence too small for commercial purposes. It is, however, my intention to continue the experiments on which these notes are based when the rains begin and the trees yield more sap. A further report will then be submitted should any new features present themselves.

Exhibits Nos. 2 and 3 are of unwashed milk coagulated by pressure, but as an insufficient weight was applied, they show a cellular structure, and are also not free from impurities.

Exhibits Nos. 4 and 5 are of shade-evaporated, unwashed milk, and are of fair quality. This method, however, cannot well be applied during the rainy season without the application of artificial heat, which I have proved to give unsatisfactory results.

Exhibits Nos. 2, 3, 4, and 5 are the results of preliminary experiments which were carried on with a view to proving the possibility of adopting, for the preparation of West African rubbers, the process described in notes already submitted to the Government of this Colony (see Government Gazette, Colony of Lagos, February 1888.)

Exhibit No. 1 shows that the method indicated has been to a certain extent successful, even under extremely adverse circumstances. It will, however, be for experts in England to point out the good and bad qualities of the samples, and to declare the price that it ought to command in the English market.

These notes have been strictly limited to the consideration of certain attempts to apply the method above described to the preparation of india-rubber from the juice of the "Abba" tree. There is now on hand a series of experiments on the "Ibo" vine juice, which may be further reported on when complete, but at present no results have been arrived at of sufficient definiteness to warrant a detailed report.

It is important to remember that the results here noted have been obtained from one series of experiments only, and are not to be considered as in any way final. They serve to prove the possibility of applying a simple and inexpensive system of preparation to African rubbers which has already produced good results elsewhere. It will always be a sincere pleasure to me to show what little I know about the subject to anybody who may be sufficiently interested by these suggestions to wish to apply them to the preparation of india-rubber for the European market, and any question addressed to me in writing will also meet with attention, and will be answered as fully as my slight knowledge of the matter may permit.

ALVAN MILLSON.

As it was the desire of the Government of Lagos to obtain an authoritative opinion upon the specimens of rubber prepared by Mr. Millson, the good offices were sought of Mr. S. W. Silver, F.L.S., who already has most obligingly assisted this establishment in the investigation of specimens of rubbers obtained from various sources. Mr. Silver was kind enough to forward the samples of "Abba" rubber to the India Rubber, Gutta Percha and Telegraph Works Company, Limited, at Silvertown.

The report received on the specimens is as follows:—

REPORT ON FIVE SAMPLES OF INDIA-RUBBER received from S. W. SILVER, Esq., 6th July 1888.

The samples are numbered in accordance with the report of Mr. Alvan Millson.

No. 1 internally was dark in colour, almost black, with a bluish fringe, tint gradually vanishing towards centre, which is nearly white. It was strongly alkaline in patches, evidently due to a little original moisture, other portions neutral.

No. 2, light (white) colour in centre, blackened about $\frac{1}{8}$ inch in depth, reddish fringe, very faintly acid.

No. 3, pink colour, blackened about $\frac{1}{8}$ inch in depth, contains much wood; slightly acid, especially in neighbourhood of woody particles.

Nos. 4 and 5. No. 5 is softer than No. 4, and lighter in colour; both samples have a pink tint and are distinctly alkaline.

Samples marked No. 1, No. 3, No. 4 were treated in detail; the quantity of the others being too small. Washing and drying, No. 1 lost 1·42 per cent. moisture, No. 3 lost 5 per cent., and No. 4 lost 7 per cent.

The temperature of the drying room was that used for the usual descriptions of rubber. If the samples had been hung up as usually adopted, the want of strength and firmness would have caused them to

drop. Other means of drying would have to be devised. When dry No. 1 was very clammy, No. 3 was firmer than No. 1, but not nearly so good as No. 4. No. 4 might be more easily handled in drying.

They were all very short, with very little elasticity, this might have been expected from appearance of the original samples. They were kept in the drying room no longer than would be required if working n a practical scale.

Mixed with a suitable proportion of sulphur and vulcanised, they cured soft and short, but were not blistered. With pigments it may be made firmer and slightly tougher. It can evidently not be used by itself in any form. All the samples were troublesome to work in the mixing machines. It would not be right to assume that this behaviour is in any way a barrier to its usefulness.

When we take into account the great improvements which have been introduced in preparing certain African and Asiatic varieties of rubber, manufacturers must feel that the praiseworthy efforts of Mr. Alvan Millson to increase our sources of supply are in the right direction. Whether the recovery of the rubber from the "Abba" tree in the way these samples have been prepared is such as to ensure the best product in a commercial sense, is a most important matter. The sap of a tree may contain a large quantity of caoutchouc, but the same may be associated with other principles contained in the same or other plant tissues, which completely modify its character. It is this consideration which would lead one to ask how far the treatment of the juice of the *Castilloa elastica* can be applied to another plant, the juice of which, though containing caoutchouc, has very marked chemical differences.

I am not aware of any native india-rubber with an acid reaction; even the juice of the Para rubber tree, *Hevea brasiliensis*, is distinctly alkaline when drawn, and exhales a strong smell of ammonia. The rubber from this source is strongly acid. In roasting the nuts of the Urucari palms, a large quantity of acetic acid is given off, which probably, by neutralizing the ammonia, brings about the coagulation of the caoutchouc, the excess of acid from the roasting of the nuts may help to explain the acid reaction of the Para rubber, but as the negrohead variety is obtained from the same source, and is *not* smoked although it is strongly acid, we must consider the generation of acid as due to fermentation, at least in a very great measure. The samples obtained from the "Abba" tree are not acid, but whether the product could be improved by precipitation with ordinary crude acetic acid, which at the same time would arrest those changes which are liable to go on afterwards, to the detriment, probably, of the rubber, is worth finding out. I thought it would be important to ascertain whether the soft clammy condition of the samples was due to oxidation, or to the presence of resinous matter. A white pulverulent resin was obtained from sample No. 4, amounting to 24·48 per cent. of its weight. The caoutchouc, by destructive distillation, yelded caoutchucene and the other products obtained from india-rubber. When resins exist in the juices of india-rubber yielding plants, as a rule they are combined with water, as hydrates, which is fatal to their use for vulcanizing, since such rubber blisters when cured. On boiling the resin with caustic potash, a large quantity of ammonia was given off. In the present case, although such a large quantity of resin is present, the rubber cures quite solid, but soft and short, this may be due to the resinous matter. The oxidation of the rubber itself will not account for it. The rubber may be hardened by pigments, but its strength is still very low. It can

be mixed with other low class rubbers with a corresponding improvement in toughness and strength.

In a locality so favourable for the growth of india-rubber producing plants, it would be interesting to know, whether any of the plants yielding good descriptions of rubber could be acclimatised successfully without invalidating the product. Common alum is sometimes found in the Para rubber, being used as a medium for coagulating, perhaps it may be useful in the present case.

I was informed by a friend who spent some time in Africa, that a very large quantity of crude acetic acid was shipped to different parts on the East Coast some years ago, and was evidently used in preparing india-rubber.

In smoking india-rubber, any plant may be used which yields acetic acid, but any plant yielding turpentine or similar products should be avoided.

The preservative action of the crude acid is enhanced by creosote and tarry matter present. Para rubber is flavoured with these.

While forming a favourable opinion of this gum, we cannot fix a value upon it, as everything will depend upon how far the experimental working can be verified in working on a larger quantity. As a supply of this is at present available, we would suggest that a larger quantity be sent over, say 100 pounds, so that we could test it in a practical manner, and thus give a better opinion as to its commercial value. We may observe that it is always more difficult to give a fair result on such small quantities, and it is therefore the more important that a supply sufficient for practical use should be sent.

India Rubber, Gutta Percha, and
Telegraph Works Co. (Limited),
Silvertown.

The results of the inquiry and the suggestions offered by this establishment are contained in the following letter addressed to the Colonial Office for communication to the Government of Lagos :

Royal Gardens, Kew, to Colonial Office.

Royal Gardens, Kew,
September 11, 1888.

Sir,

I am desired by Mr. Thiselton Dyer to acknowledge the receipt of your letter of the 16th June last forwarding papers and specimens from the Government of Lagos, relative to some experiments which had been made by Mr. A. Millson on the preparation of rubber from the Abba tree.

From the botanical specimens forwarded by Mr. Millson, Professor Oliver has arrived at the conclusion that this particular "Abba" tree is probably *Ficus Vogelii*, Miq., a West African rubber tree first collected by Vogel at Grand Bassa. This determination, however, owing to the character of the specimens, is not quite conclusive. It is very desirable that a full set of material be sent in all cases of this kind, which should contain young terminal shoots, as well as, portions of the branches, leaves, flowers, and fruits.

The various samples of rubber as received were forwarded, through S. W. Silver, Esq., F.L.S., to the India Rubber, Gutta Percha, and Telegraph Company (Limited) at Silvertown. The samples have received a very careful and exhaustive examination at their hands, and we have received from Mr. Silver a full report, a copy of which is herewith enclosed.

It is necessary in the first place to point out that rubber from the Abba tree similar to that under notice has already been investigated at this establishment. In the Kew Report for the year 1878, p. 39, a notice appears of Liberian rubber, which was identified with *Ficus* (Urostigma) *Vogelii*. This rubber, a sample of which is in the Kew Museums (from Mr. Thomas Christy) is made up into balls about the size of a large orange. It was valued (in 1878) at 1*s.* 6*d.* per pound, but it is added that "if sent home cleaner it would command a higher price."

It will be noticed that in the report furnished by the India Rubber, Gutta Percha, and Telegraph Works Company it is stated that the specimens received from Mr. Millson show an alkaline reaction and that on this and other grounds, such as the presence of resin and its soft clammy condition, "it can evidently not be used by itself in any form."

Mr. Millson's experiments are evidently based on his knowledge and experience of Central American rubber the produce of *Castilloa elastica*. It is probable, however, that the treatment suitable to the juice of this plant cannot be applied to another plant the juice of which, although containing caoutchouc, has very marked chemical differences.

The result of the inquiry so carefully conducted by the India Rubber Company would appear to show that the juice of *Ficus Vogelii* does not lend itself satisfactorily to such treatment. It is said that the rubber hitherto prepared from this tree has been treated with acetic acid, and, if this is the case, possibly in this direction may be found a solution of the problems involved.

It is desirable in any future experiments carried on with india-rubber on the West Coast that larger samples be forwarded to this country for the purpose of testing the quality. In the report it is stated that about 100 pounds is necessary to test rubber in a thoroughly practical manner.

In order to afford every information to the Government of Lagos in its praiseworthy efforts to develop the rubber industry of the Colony there is forwarded herewith a parcel containing samples of "Abba" rubber in different stages of manufacture, together with specimens of commercial Para* and Accra rubbers now in large demand in this country.

If the experiments are continued, as it is hoped they will be, and if the valuable suggestions contained in the report are carefully carried out, it is pretty clear that Mr. Millson will be able to discover a practical and efficient method of preparing the juice of the Abba tree so as to produce commercial rubber.

There are few subjects at the present time of greater importance than a careful investigation of caoutchouc plants, and the extensive distribution of Abba trees in West Africa indicates a wide and useful field of inquiry.

I am, &c.
(Signed) D. Morris.

Sir R. G. W. Herbert, K.C.B.,
Colonial Office.

Mr. Alvan Millson to Royal Gardens, Kew.

Badagry, West Africa, August 16, 1888.

Your letter of the 4th ultimo reached me yesterday. I regret that the samples of rubber sent by me were—owing to the difficulty of

* Para rubber is yielded by *Hevea brasiliensis* and Accra rubber by *Landolphia owariensis*.

obtaining pure milk—both small and of inferior quality to those which have since been made. I was sorry also not to have had an opportunity of correcting the notes for the press, as I notice several misprints in them.

You were correct in your belief that the name "Abba" is applied to all arboreous fig-trees in this neighbourhood. Of these there is a remarkable variety. I will at a later date send specimens prepared as you so kindly direct me.

An enterprising firm of Lagos merchants, who have lately established a branch house in Badagry, have made a fair beginning in the rubber business.

So far as I can at present see West African rubber will never be reliable so long as the natives have the preparation in their own hands. The milk bears transport well, keeps well, and can easily be tested, by letting a sample (mixed with water) stand for twelve hours in a glass vessel. Unless merchants employ reliable men to buy and coagulate the milk, I fear that the trade will be of a very ephemeral nature. Yet on the other hand it seems clear, from the large numbers of rubber-giving fig-trees, that a properly conducted trade would be a considerable source of future prosperity to the whole coast. The present palm oil and kernel trade may be said to depend upon the continuance of slavery, and is indeed in many ways an injury to the people.

The Governor of the Colony, with his usual insight, is encouraging cocoa-nut planting and other similar industries, which will do much to improve the general prosperity. He has already proved that the india-rubber industry is by no means the least important of these branches of commerce.

ALVAN MILLSON.

LXI.—LIBERIAN COFFEE AT THE STRAITS SETTLEMENTS.

(*Coffea liberica*, Bull.)

About 15 years ago the introduction of a new species of coffee, now known as *Coffea liberica*, to supplement *Coffea arabica* which had hitherto been exclusively cultivated, was looked upon with considerable interest. At that time the coffee plantations in Ceylon and India were threatened with partial, if not total, extinction by the prevalence of a fungoid pest known as the Ceylon coffee-leaf disease (*Hemileia vastatrix*). In the West Indies the once prosperous coffee plantations of Dominica, Jamaica, and Demerara had gradually been reduced owing to the attacks of the white fly (*Cemiostoma coffeellum*), the exhaustion of the soil, and the pressure of other, and for the time, more remunerative cultures. It was claimed that the new coffee was more hardy than the Arabian; that it could withstand, without injury, the attacks of insect and fungoid pests; and that it was suitable for cultivation at lower elevations and in localities more easily accessible as regards facilities for labour and transport.

The scientific discoverer of Liberian coffee appears to have been Afzelius. It was described and figured by Hiern in the Transactions of the Linnean Society. [Second Series, Bot. I., p. 171, t. XXIV.] It is also described by the same author in *Flora of Tropical Africa*, vol. III., p. 181.

Liberian or Monrovia coffee is a native of Upper and Lower Guinea, and was cultivated on the West Coast of Africa in several localities before it attracted any notice in Europe. It was first introduced as a cultivated plant into the Royal Gardens, Kew, in 1872. It was largely owing to the action of this establishment that Liberian coffee, within a short period, was widely distributed for experimental purposes throughout British possessions in the tropics.

Particulars respecting the distribution of Liberian coffee plants from Kew, and the early history of its culture in different parts of the world, are given in the Kew Reports every year from 1872 to 1882.

It is well known that the successful cultivation of Arabian coffee is restricted to hilly or mountainous districts, and that only in such districts will the produce attain its highest value. The Liberian coffee, on the other hand, being a native of the comparatively low hills of West Tropical Africa, is suited to hotter conditions than the Arabian coffee, and it can be successfully cultivated in districts quite unsuited to the latter. In this lies the chief merit of the new coffee.

As a commercial article Liberian coffee has not hitherto proved so valuable as was at one time supposed, and the cultivation, though widely distributed, has not become general in any part of the world. There are, doubtless, good reasons for this. It has been found, for instance, that the "cherries" of Liberian coffee do not become soft and pulpy when ripe, but remain hard and fibrous. Hence it has been found difficult to husk the beans, as the machinery found suitable for preparing Arabian coffee is not applicable to the Liberian coffee. Again the "parchment" skin in the latter is tough and woody, and the labour and percentage of waste entailed in "cleaning" is increased, while the actual market value is less. Probably, also, in the cultivation of Liberian coffee the localties selected for plantations have, in many cases, been subject to prolonged droughts, whereas the species evidently prefers a warm, moist climate with abundant rains well distributed through the year.

Should the present high price of coffee be maintained it is not unlikely that the cultivation of Liberian coffee will prove sufficiently remunerative to warrant further attention being paid to it.

We understand that in Java the Liberian coffee cherries are fermented before they are pulped. It is claimed that this process enables the coffee to be cleaned much more readily, and that the coffee ultimately produced is brighter in colour and of better quality.

This, if verified, is a fact of some importance to the growers of Liberian coffee.

We have been led to make the foregoing remarks and review the present position of Liberian coffee owing to a very fine sample of this coffee which lately reached us from Malacca, and upon which is based the following correspondence :—

Mr. R. Derry, Forest Department, Malacca, to Royal Gardens, Kew.

Malacca, 30 July, 1888.

I am sending you per steamship "Ajax" (Ocean Steam Ship Company) a small case containing two samples of Malacca-grown Liberian coffee. One sample has the parchment cleaned, and the other left on. So far, no Malacca coffee has been shipped to Europe. I should be glad to learn the value of the samples sent, and whether Malacca coffee would be likely to meet with a market at home.

R. Derry.

Messrs. Lewis and Peat to Royal Gardens, Kew.

5, Mincing Lane, E.C.,
September 15, 1888.

We are favoured with yours of the 12th instant with samples of coffee which we find as follows:—No. 1, very good, bold, clean Liberian, well prepared and the best we have seen, value about 75*s.* per cwt.; No. 2, in parchment, very hard and apparently overdried, colour and quality of bean very inferior to No. 1, probably owing to being overdried, value about 30*s.*, 35*s.* per cwt., if cleaned 55*s.*, 60*s.* per cwt. This coffee could be cleaned in London by the process described in our letter of the 17th April,* but we doubt if a machine that is used for ordinary coffees such as East Indian or West Indian would clean such hard coffee as No. 2 sample. We shall be able to give you more information later, as we have just received a consignment of similar coffee in the parchment from Johore, and it will have to be cleaned and sold and we shall have much pleasure in giving you the result.

Lewis and Peat.

Messrs. Lewis and Peat to Royal Gardens, Kew.

6, Mincing Lane, E.C.,
October 5, 1888.

Referring to ours of the 15th ultimo, re Liberian parchment coffee, Malacca, we beg to say the London cleaning of the same has not proved nearly so satisfactory in the result as the sample sent to us by you and cleaned abroad, upon which we reported, as ours turned out mu-ty and very rough. We attribute the failure to the fact that the coffee was not properly dried, and that the parchment of this coarse coffee gets very hard and difficult to clean when left long before cleaning. We certainly think if such results can be attained on the other side, as shown by your sample from the Tan Hun Guan estate at Durian Tungal [Malacca] it would be folly to send the coffee home here in parchment. Our shipment consisted of 110 bags in the parchment and weighed 122 cwts. The out-turn after cleaning gave:—

35	bags	bold	which sold at	68*s.*	per cwt.
9	„	medium	„	60*s.*	„
5	„	peas	„	70*s.*	„
2	„	triage	„	45*s.*	„

The loss in weight was 34 cent., which we consider excessive.

Lewis and Peat.

The large per-centage which the parchment of Liberian coffee bears to the clean beans, a fact which we have already noted, is fully borne out in the above trial.

The information contained in this correspondence will doubtless prove of considerable interest to growers of Liberian coffee, and may help to solve some of the difficulties which still hamper the industry.

If this trial is conclusive, it would appear that it is not desirable to ship Liberian coffee to this country either in the dried cherry or in the parchment. Owing to the large bulk of these coverings the coffee must be cleaned on the spot. It would be interesting to learn the particulars of methods, if any, which have successfully dealt with this problem.

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* See *Kew Bulletin*, No. 17 [May 1888], p. 132.

LXII.—TEA OIL AND CAKE.

(*Camellia Sasanqua*, Thunb.)

In the Annual Report of the Government Analyst of Hong Kong for the year 1887, attention is drawn to the use of a substance called *Ch'á tsai ping* for poisoning fish. This substance is said to be the residual cake of the seeds of *Camellia Sasanqua*, Thunb., after the oil is extracted. Its action on fish, due to the presence of a glucoside, giving most of the reactions of saponin, has already been known and described, amongst others, by McCullum (Pharm. Journ. (3), Vol. xiv., p. 21). It appears that the fish killed by the *Ch'á tsai ping* may be used as human food without any ill effects.

A complete set of the seeds of *Camellia Sasanqua* are in the Kew Museum from China and Japan, and a sample of the oil from Japan. A specimen of oil-cake, and a decoction of the same, as used in China for various purposes, are also in the Museum from Hong Kong.

In connexion with this subject, the following notes have been prepared by Mr. Charles Ford, F.L.S., Superintendent of the Botanical and Afforestation Department, Hong Kong. From these notes it would appear that *Ch'á tsai ping* might be turned to a useful purpose in destroying worms in soil in which pot plants are grown, and also in eradicating them from grass lawns.

Botanical Gardens, Hong Kong,
September 20, 1887.

In reply to your inquiries concerning the preparation and uses of *Ch'à tsai ping* (made from the seeds of *Camellia Sasanqua*), I have much pleasure in being able to furnish you with some information.

While on a botanical tour in the Kwangtung province, from which I have just returned, I had an opportunity of inspecting plantations of the shrub from which the material is obtained, of seeing mills in which the article is prepared, and of receiving information on both the cultivation of the plant and the preparation of *tea oil* from an intelligent and courteous old Chinese gentleman.

Camellia Sasanqua, Thunb., is extensively grown in South China for the production of seeds which yield a valuable oil known as *tea oil*. *Ch'à tsai ping* is the refuse matter left after the oil has been expressed. The preparation is very simple. The seeds are collected in October or November, dried and taken to a mill, where they are crushed in a circular mortar or trough by a pestle drive through it by water power. The seeds after being crushed are steamed, and then the mass is placed in a powerful press, which expresses the oil. The refuse, after the extraction of the oil, is the article known as *Ch'á tsai ping*. It is produced in cakes weighing, when dry, about 3 ozs. and 3½ lbs. respectively. The quality of the two kinds of cake is the same. I am not aware that anything besides the seeds of *Camellia Sasanqua* enters into the composition of these cakes.

Ch'á tsai ping is used by the Chinese as a hair wash, and as soap for cleansing both the person and clothes. It is also used for the eradication of earth-worms from the soil in which plants in pots are grown. In these gardens we also use it for eradicating earth-worms from grass lawns. For this purpose the cake is crushed and boiled. The decoction is then diluted and poured on the grass when the worms come to the surface of the ground. As a rule the small worms die, but the larger

ones after a time recover. After being picked up from the grass the worms are often given to fowls and ducks, which devour them readily and apparently thrive on them, experiencing no inconvenience from the effects of the *Ch'á tsai ping* with which the worms were killed.

CHAS. FORD.

In *Index Floræ Sinensis*, Vol. I., p. 81, it is pointed out that *Camellia drupifera*, Lour., and *C. Sasanqua*, Thunb., are so closely allied that imperfect specimens are very difficult to determine. Mr. Ford's specimens of the former, collected in the Kwangtung province, may belong to the latter. A full synonymy of the species may be found in the *Index Floræ Sinensis* as above.

LXIII.—DEMERARA PINK ROOT.

(*Spigelia anthelmia*, L.)

We recently received from St. Vincent, West Indies, specimens of a plant which was represented "to be poisonous to cattle, sheep, and "goats, and to prove fatal in two or three hours." This plant was identified by Professor Oliver as *Spigelia anthelmia*, L. a member of the natural order *Loganiaceæ*, commonly distributed throughout the tropical parts of continental America and the West Indies. It is a glabrous annual, with two pairs of upper leaves so closely approximate that the plant somewhat resembles *Paris quadrifolia*. The flowers are small and tubular of a white and pink colour arranged in a unilateral scorpiod raceme. The fruit when ripe is purple.

This species is figured in Browne's Jamaica, t. 37, f. 3; in Tussac's *Flora Antillarum*, IV., t. 8, and in Descourtilz *Flore Médicale des Antilles*, I., t. 61. There is also a figure, a poor one, in the Botanical Magazine, t. 2359. In the latter publication it is stated that "*Spigelia* "*anthelmia* is a plant of considerable efficacy for the cure of worms "and febrile diseases, supposed to arise from the presence of worms. "It was first brought into notice by Dr. Patrick Browne in the Natural "History of Jamaica . . . . There can be no doubt this and the "allied *S. marilandica* are very efficacious remedies, but whether from "the unpleasant narcotic effects which they sometimes produce, "especially on the eyes, or some other cause, they seem now to be very "much neglected." In Bentley and Trimen Med. Plants, 180, it is stated that "the root and herb generally of *Spigelia anthelmia* is a "popular remedy in British Guiana as an anthelmintic. Its effect is "said to be even more certain and marked than that of the official "pink root (*S. marilandica*). Lunan in *Hortus Jamaicensis*, p. 306, describes *Spigelia anthelmia* as "a powerful vermifuge which "administered incautiously has proved fatal."

There can be no doubt that this plant possesses such drastic properties as may render it exceedingly dangerous as food for cattle and sheep that may be driven to feed upon it. We have no evidence heretofore, that animals have been actually killed by eating the leaves, but the fact is by no means an improbable one. The only practical remedy we can suggest is to keep pastures free from such plants and to destroy them wherever stock are likely to have access to them.

LXIV.—FOOD GRAINS OF INDIA (continued).

Coix gigantea, Roxb.

In discussing a new variety of the ordinary Job's tears (*Coix Lachryma*, L.), it was mentioned in *Kew Bulletin* for June 1888, p. 144, that the fruit possessed little or no nutritive value in the wild state, and its use was restricted to a few aboriginal tribes in Eastern Bengal and Assam.

At that time we were aware that some cultivated plants of *Coix* yielded a comparatively nutritive grain, but their determination was by no means certain.

We have now obtained, on the suggestion of Sir Joseph Hooker, sufficient information to warrant us in drawing the conclusion that the cultivated *Coix* in the Khasia hills as also the cultivated *Coix* of Sikkim belongs not to *Coix Lachryma*, L., but to *Coix gigantea*, Roxb. This latter is a recognised species quite distinct from *C. Lachryma*.

Coix gigantea, Roxb. Fl. Ind. III., p. 570. According to Roxburgh the culms of this species are *perennial*. They are erect, branching to the top, round, smooth jointed, from 8 to 15 feet in height and as thick as a man's thumb at the base. The leaves are from 2 to 4 feet long and about 1 inch broad, *subcordate at the base;* the upper side and margin backwardly hispid. The sheaths are short and smooth. The spikes are numerous, pedicelled, and terminal. The male flowers above the female as in the genus, *but numerous and three fold;* the two lateral ones sessile, and the middle one pedicelled; they are *closely imbricated round the whole of the spike*. The involucre is ovate, entire round the circumference . . . smooth, glossy . . . . and [in the wild plants] exceedingly hard.

The portions of the above description in italics indicate the characters which separate this species from *C. Lachryma*. Other points of distinction are to be found in the generally larger size of the plants; in the absence of spathes to the pedicels; and in the pedicels not being jointed (*i.e.* the fruit is persistent). The chief character of *C. gigantea* as distinguished from *C. Lachryma* is, however, to be found in the male flowers. These are arranged in groups of three, the two lateral being sessile, while the middle one is pedicelled. In *C. Lachryma* the male flowers are few in number arranged loosely in the spike and always in pairs,—one sessile and the other pedicelled. The male flowers in *C. gigantea* are numerous, and closely inbricated in a spike nearly twice as long as in *C. Lachryma*.

Roxburgh gives the habitat of *C. gigantea* "chiefly in the valleys "amongst the Circar mountains and in Bengal." There are specimens in the Kew Herbarium from East Bengal (Griffith); from Syong in the Khasia Hills (Hooker and Thomson, 1850), marked "the usual cultivated cereal;" from Sikkim, 4,000 feet, wild plants and also specimen marked "cultivated;" from Mysore, Carnatic, and Malabar (Stocks and Law); and from Gangetic Plain (Duthie, 1885).

This species is not mentioned as cultivated either by Roxburgh or Griffith. In most works on economic botany the use of the grain of *Coix* is exclusively associated with *C. Lachryma*. This is doubtless an error of identification. We have no evidence that *C. Lachryma* is cultivated for the sake of the grain, although, as in the Naga Hills, Assam, and in N.W. Luzon, Philippines (*fide* Vidal), the grain is gathered from

wild plants and eaten. In Sir Joseph Hooker's *Himalayan Journals*, vol. ii., pp. 289 and 313, it is stated that "a good deal of *Coix* is culti-
" vated in the Khasia Hills; the shell of the cultivated sort is soft and
" the kernel is sweet, whereas the wild *Coix* is so hard that it cannot
" be broken by the teeth; each plant branches two or three times from
" the base, and from seven to nine plants grow in each square yard of
" soil; the produce is small, not above 30 or 40 fold."

The specimens collected by Sir Joseph Hooker when in Khasia, which are now in the Kew Herbarium, show that the cultivated *Coix* of this district is *C. gigantea*. So also is the cultivated *Coix* of Sikkim.

Dr. Smith, quoted in the *Catalogue of the Vienna Exhibition*, 1873, speaks of the grain of *Coix* (a description which exactly suits this species): "as larger and coarser than pearl barley, but is equally good
" for making gruel. As it is sold for 5*d*. per Chinese pound it makes
" an excellent diet drink for hospital patients in China." Further, in Mason's Burmah, under Coix Millet, p. 476, it is stated that a species of *Coix* with large esculent seeds, known as *Kalepoukpouk*, which are treated like Indian corn, are often for sale in the bazaars, and are cultivated very extensively by the Red Karens.

In order to supplement the information contained in the Food Grains of India, Professor Church, F.R.S., has been good enough to analyse a sample of the cultivated grain of *C. gigantea* in the Kew Museum (marked 182—1886). This was obtained from the Indian Court at the Colonial and Indian Exhibition. The following is the Report kindly furnished by Professor Church:—

Coix gigantea, Roxb.

In the sample submitted to analysis it was found that each fruit after removal of the involucre weighed on the average no less than $1\frac{1}{2}$ grains. From four parts by weight of the sample three parts of husked grain were obtained,—three times the quantity yielded by *Coix Lachryma*.

Composition (in 100 parts).

Water	14·8
*Albuminoids	16·8
Starch, &c.	59·9
Oil	5·8
Fibre	0·9
Ash	1·8

The "nutrient-ratio," or proportion of albuminoids to starch plus oil converted into its starch-equivalent, is here 1 : 4·4; the total nutrient value is 90.

The quantity of albuminoids in these husked seeds is remarkable; it approaches the per-centage found in some kinds of pulse. The nutrient value is high; and the proportion of oil or fat is larger than that present in the great majority of cereals. Speaking generally, the results of the present analysis correspond very closely with those obtained in the analysis of *Coix Lachryma* (Food Grains of India, p. 60).

A. H. C.

The practical point brought out in this analysis is that the cultivated plants of *C. gigantea* yield 75 per cent. of clean grain, whereas the wild

* Containing 2·66 nitrogen.

plants of *C. Lachryma*, with which they have hitherto been confused yield only 25 per cent. of clean grain. In both species the chemical composition of the grain is remarkable for the quantity of albuminoids it contains, and if the soft-shelled cultivated form of *C. gigantea* was more prominently brought into notice, it might prove a much more valuable cereal than many now in use in various parts of the tropics.

LXV.—YORUBA INDIGO.

(*Lonchocarpus cyanescens*, Benth.)

With Plate.

In the *Kew Bulletin* for March 1888, p. 75, will be found a summary of information respecting African indigo plants, with especial regard to what is known as Yoruba indigo. For more than 30 years, since Barter first brought back specimens from the Niger expedition, the exact determination of the plant yielding Yoruba indigo has been keenly sought. Plants were raised from seed sent to Kew by Captain Moloney, C.M.G., and one of these plants sent to Ceylon had recently flowered and fruited in the Botanic Gardens at Peradeniya. From specimens obligingly communicated to us by Dr. Trimen, F.R.S., we are enabled, by the courtesy of the Bentham Trustees, to give a drawing of the plant with a brief description by Professor Oliver taken from the forthcoming part of the *Icones Plantarum*.

Lonchocarpus cyanescens, Bentham in *Journ. Linn. Soc.*, IV. (*Suppl.*) 96: a shrub of twining habit, belonging to the tribe *Dalbergieæ* of the Natural Order *Leguminosæ*. Stem often 20 to 30 feet long, the branches glabrous or slightly silky. Petioles firm, woody, 2–3 inches long; leaflets, 9–13, oblong, 3–5 inches long, pointed, the base rounded, the lower ones shorter, coriaceous, upper side smooth, lower side minutely pubescent. Flowers in copious often fascicled panicles, sometimes a foot long, the branches short, spreading, densely flowered but not fascicled. Bracts lanceolate, subulate, deciduous, equalling the pedicels, one line long. Calyx finely grey-silky, the teeth deltoid. Corolla three times as long as the calyx, violet. Pod 4 to 8 and sometimes 10 inches long, 1—1¼ inches wide, narrowed at both ends, stalked, cartaceous strongly reticulated.—Baker in Oliver Flora Trop. Africa, ii. 243; Robinia cyanescens, Schum. et Thonn., Guin. Plant. 351.

The habitat is given as West Tropical Africa : Niger (Nupe), *Barter;* Lagos, *Rev. J. B. Wood;* Fernando Po, *Mann;* Gold Coast, *Capt. Moloney;* and perhaps the same from Senegambia and Sierra Leone.

Professor Oliver states: "This species is the indigo of the "Yoruba country, a region north of Abbeokuta, and goes by the name "of 'Yoruba Indigo.' Mr. Bentham was the first to identify our "plant with Schumacher and Thonning's *Robinia*, the specific name "of which he of course took up under its present genus. I cannot be "quite certain however of this identity, S. and T. describing the pods "of their plant as pubescent, whilst ours even immature are glabrous, "and they omit all reference to the conspicuous reticulation of the "pericarp."

Barter's manuscript note on the specimens sent by him to this country in 1859 is as follows:—

"Indigo of the Yoruba country. Leguminous shrub of twining habit and large growth. Flowers in loose panicles, at first pink changing to

M. S. del et lith.

Lonchocarpus cyanescens Benth.

a faded blue. Common near rivers; plantations of several hundred acres of this are about Abbeokuta. In cultivation the plant is kept about 7 or 8 feet high; long shoots are cut close, and it becomes short and spurred and bushy, like *Wisteria sinensis* when similarly treated. The leaves are gathered young (as seen in the specimen), merely powdered in a mortar into a black pasty state, made into balls the size of double fists, and dried for the markets. In dyeing, one ball to a gallon of water is used; the cloth allowed to remain four days. The dye is fixed with potash; a fine deep blue is produced, very permanent."

In recent years we are entirely indebted to Captain Moloney, C.M.G., Governor of Lagos, for specimens of the plant and ultimately for the seeds which have been the means of affording us a scientific determination of the species.

Selected specimens of Yoruba indigo were brought to this country by Captain Moloney in 1883, and a portion of these were submitted to Dr. Hugo Müller, F.R.S., who is well acquainted with the commercial value of indigo samples. Yoruba indigo was worth from 4*s.* to 4*s.* 6*d.* per lb., as compared with fine Bengal, which is worth from 7*s.* to 7*s.* 6*d.* per lb. It contained, however, a good deal of earthy matter; and if this could be eliminated in the manufacture, it would, of course, be worth more. [Thiselton Dyer in *Journ. Linn. Soc.*, vol. xx. p. 404.]

It is needless to point out that the ordinary indigo of commerce is obtained from two or three species of Indigofera (*I. Anil.*, *I. tinctoria*, &c.). It is imported to this country chiefly from India, Philippine Islands, and Central America. Of the total imports (in 1887) of 76,700 cwts. of the value of 1,673,067*l.*, more than 68,000 cwts. came from India.

Other plants yielding indigo or a colouring matter similar to true indigo are: *Isatis tinctoria*, L., the well-known Woad; *Polygonum tinctorium*, Lour., which furnishes Chinese or Manchurian indigo; *Strobilanthes flaccidifolius*, Nees, furnishing the Room or Maigyee dye of Assam and South China; *Wrightia tinctoria*, R. Br., used in India; *Tephrosia tinctoria*, Pers., used in Mysore; and *Marsdenia tinctoria*, R. Br., in Burma and Sumatra.

LXVI.—TRINIDAD IPECACUANHA.

(*Cephaelis tomentosa*, W.)

It is well known that the demand for the officinal Ipecacuanha* is steadily increasing, while the supply of the drug is either stationary or gradually becoming scarcer. Inquiry is therefore naturally directed to plants that may possess similar properties in the hope that they may serve to supplement or replace the drug hitherto exclusively in use. As a case in point, we find that the bark of *Sycocarpus Rusbyi*, Britton, known in Bolivia as Cocillaña, is in course of being investigated, "because it contains a strongly active principle, somewhat "relating to emetine as to its physiological action," and in the hope that "the close resemblance of its properties to those of ipecacuanha will

* A note on the officinal Ipecacuanha (*Cephaelis Ipecacuanha*, Rich.) was given in the *Kew Bulletin* for the month of May last, p. 123. In this note the introduction and successful cultivation of this valuable plant in the East Indies were fully discussed.

" qualify it to replace to some extent that drug which has now become " so scarce and high."

A short time ago we received from Mr. J. H. Hart, F.L.S., Superintendent of the Botanic Gardens at Trinidad, specimens of the roots and leaves of *Cephaelis tomentosa*, W. He found these were in use in Trinidad as an emetic, and hoped that their physiological action might be due to the same principle as that existing in the true Ipecacuanha.

The plant is a tall shrub, with the younger parts of the stem and leaves covered with a shaggy tomentum. The leaves are elliptical, or elliptical oblong, acute. The stipules are prominent, two on each side, and long acuminate. The flower heads are terminal with two purple-red bracts. The latter remain revolute on two sides, exposing the flower heads. The individual flowers are yellow, while the ripe fruit is succulent and pale blue in colour. An old drawing of this plant, not very good, appears in Aublet *Plantes de la Guiane Françoise*, t. 61. A more recent drawing appeared in the Botanical Magazine, t. 6696, from a plant grown by Messrs. Veitch at Chelsea. The species is described "as a very singular plant, congeneric with that yielding " medicinal Ipecacuanha, but of very different appearance, a native of " tropical America, where it extends from Mexico through British " Honduras, Nicaragua, United States of Columbia, British Guiana, " to equatorial Brazil on the east, and to Peru on the west side of the " Andes. It is found in Trinidad, but in no other of the West India " Islands."

The specimens of stems and roots (but apparently not the leaves) forwarded by Mr. Hart have recently been investigated by Mr. Francis Ransom and a note giving his results was read before the Pharmaceutical Conference held at Bath in September last.

It was found that traces of an alkaloid were present resembling emetine, but the quantity was so inappreciable that the plant could not be utilized commercially as a source of Ipecacuanha. The summary of Mr. Ransom's paper, as it appeared in the *Pharmaceutical Journal*, [3], vol. xix., p. 187, is as follows:—

"Mr. Ransom read a note on the examination of the root and stem of *Cephaelis tomentosa*, said to be used in Trinidad for the same purposes as the root of *C. Ipecacuanha*, though the root is totally unlike that drug, both in external appearance and internal structure. The presence was ascertained of traces of an alkaloid which gave a reaction with mercuric chloride resembling that of emetine. But as the physiological action of 60 grains of the root was inappreciable, the amount of alkaloid present must be very small."

LXVII.—TREATMENT OF VINES IN FRANCE.

The Foreign Office has communicated the following letter addressed to Her Majesty's Ambassador at Paris by Mr. J. A. Crowe, C.B., Commercial Attaché for Europe, respecting the present condition of the Vine-culture in France:—

My Lord, Paris, October 18th, 1888.

In August last Mr. Viette, Minister of Agriculture, paid a visit to the wine-growing districts of France; and he is understood to have returned with a very hopeful report on the prospects of this year's vintage. The

points to which the Minister gave special attention were grafting on American vines, submersion, the cure of phylloxera by sulphide and sulpho-carbonate of potassium, and the destruction of black rot and mildew by what is known as the "Bouillie Bordelaise."* The methods of grafting are described as having been perfected and successfully extended in the Médoc and the department of the Hérault and Gard.

On the 17th instant Mr. Viette communicated to his colleagues and to the press the substance of the information he has received respecting the vine crop.

The old area of vineyards has, it appears, been almost entirely replanted in the Hérault and Gard. The total yield of wine for 1888 is forty million hectolitres, or 77,000,000 gallons as against thirty-four million hectolitres or 68,000,000 gallons in 1887. In the Hérault the vintage was 3,500,000 hectol. last year, and 8,000,000 this year. The Gard yields this season 6,000,000, the Gironde, 2,500,000 hectol.

Nothing is said in these reports of the quality of the wine. The accounts I have had from departments less to the south than those above noted are not very favourable as to the ripeness of the grape or the sweetness of them.

I have, &c.
(Signed) J. A. Crowe.

LXVIII.—HUSKLESS BARLEY.

In 1884 Mr. Duthie, Superintendent of the Government Botanical Gardens, Saháranpur, brought to England and presented to the Kew Museum "a remarkable variety of loose-grained barley of a dark colour, "grown from a small sample exhibited at a previous agricultural show "at Saháranpur by a Zamindar of the Muzaffarnagar District." Messrs. MacDougall Brothers were so good as to give the following report upon a portion of the sample :—

Millwall Docks. July 19, 1884.

We have much pleasure in receiving your letter of 11th instant with samples of wheat and barley. I have shown them to most of the principal people in the corn market, who took much interest in them.

The barley was looked at with much interest and many opinions expressed upon its being quite new ; the value varied from 23*s.* to 30*s.* per 400 lbs.

I notice on damping it that each grain sprouts well and so will malt, but the colour comes off and so would not do (it is thought) for pale ales, but it would do well for stout. For feeding purposes it would be useful, although it would take time to remove prejudice to its colour. Is this seed likely to grow better than the ordinary barley, or is it possible to grow a huskless barley of the ordinary colour ?

I am much obliged to you for sending these samples, which are so very interesting, and shall always be pleased to give you any information in my power.

I am, &c.
John McDougall.

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* *Bouillie Bordelaise* is a name applied to a special mixture used in France for the treatment of mildew in vines. It is composed of water 100 litres, sulphate of copper 3 kilos., and lime 1 litre.

Mr. Duthie gave the following additional information in his report for the year ending March 31, 1885 :—

"The chocolate-coloured barley produced 15 maunds grain and 12½ maunds straw per acre. The yield of grain was thus heavier than the yield of straw. The objection as to colour, alluded to in the report, is fatal to its value, and will prevent its even being grown, except as a curiosity ; we possess a white-grained variety of huskless barley, and a good large sample of this has lately been sent to Kew for special report. The huskless barleys appear to be quite unknown in England, and as everything except colour was favourably commended, as in the case of the variety sent, I am in hopes that the report on the whole variety will be altogether favourable, and perhaps become the means of bringing this barley to the notice of the English market."

This sample was duly received, and was submitted to Messrs. MacDougall Brothers. They stated that the white huskless barley was looked upon in the London market with very great interest, and would, they thought, be of very considerable value. The sample was, however, very much weevilled, and it was hardly possible to pick out a sound grain. Messrs. MacDougall, however, thought that if it was possible to send this barley in a sound condition, it would command a ready sale at a high price. With regard to the origin of these curious cereals, a communication was read from Captain Pogson at the meeting of the Agricultural and Horticultural Society of India on January 29, 1886, in which it was stated that Indian wheat-barley, as he termed it, was introduced into the Punjab and North-western Provinces during 1881, when considerable success was secured in the Punjab. He further stated that the seed was obtained from Poo in Thibet. Three varieties of huskless barley are largely cultivated in Thibet, namely, the white, the dull green, and the dark brown (chocolate-coloured).

There is nothing further to record about this huskless barley till the present year, when the specimens in the Kew Museum attracted the attention of Mr. Horace T. Brown, of Burton-on-Trent, who has communicated the following interesting observations, which he has kindly allowed to be published :—

Mr. Horace T. Brown to Royal Gardens, Kew.

47, High Street, Burton-on-Trent, June 22, 1888.

The samples of "skinless" barley which your Assistant Curator was good enough to give me have turned out of considerable interest. Of the two from Saháranpur the *black* sample only was capable of germination. I find, on making sections of this barley, that the stain, which is of a dark purple, resides almost wholly in the *testa*, especially in the neighbourhood of the ventral "furrow," the *pericarp* being quite uncoloured.

Owing to this natural staining process, the differentiation of the two envelopes of the caryopsis is far more evident than is usually the case.

It would be of interest to know if the paleæ of this barley, none of which are included in the sample, are also coloured, as is the case with the paleæ of black oats.

In the black Saháranpur barley the plumula grows normally along the *mesocarp*, but as it thickens at the base during growth the pericarp is ruptured, and the tearing sometimes extends half way along the grain. This would militate considerably against its value as a malting grain

since the embryo would be very liable to be separated during the turning of the grain.

The sample of white skinless barley from Kotgahr, which, by-the-bye, germinates well, is almost free from this defect, owing to the pericarp being somewhat stronger. The black Saháranpur barley consequently stands, in this particular, intermediate between ordinary barley and wheat, where the pericarp is so thin that the plumula bursts through it at once, instead of progressing along its normal path in the mesocarp.

In wheat this is evidently a peculiarity brought about by cultivation, for I have found in wheat the same marking out of the normal course of the plumula as in barley, as indicated by the slight tendency of the pericarp to separate in its meso-coating along the dorsal longitudinal line which the plumula ought to take. We must, I think, conclude from this that in *primitive wheat* the pericarp was strong enough, either by itself, or by the aid of the paleæ, which may then have been adherent, of retaining the plumula until it may its way out at the point of the grain. There are several manifest advantages in this which have been lost by the selection of thin-skinned varieties.

I am not aware of any varieties of wheat where the plumula is retained in the pericarp, but there may possibly be such, and I should imagine that in this case they would be related more closely to the parent stock than our ordinary varieties.

If you could get for me any fresh samples of naked Indian barley I should esteem it a favour. One would like to know something about the nature of the colouring matter of black barley.

Captain Pegson in his *Manual of Agriculture for India*, 1883, pp. 120–125, has given fuller details with respect to the introduction of huskless barley into India. *Duthie and Fuller, Field and Garden Crops of N.W. Provinces and Oudh* (*Sub.* Tab. 2) identify it with *Hordeum gymnodistichon*. The Kew Herbarium contains a specimen collected at Kyunglung, Tibet, alt. 14,000 ft., by Lieut.-Gen. Strachey, C.S.I., of a 4-rowed barley with the name *Hordeum cæleste*, Viborg.

LXIX.—RAMIE.

The subject of the utilization of the Ramie plant (*Boehmeria nivea*, Hk.) is one which has been closely followed at Kew for many years. The importance of the subject in India and the Colonies has led to considerable correspondence being addressed to this establishment. Specimens of Ramie stems, grown at Kew, have been supplied, as far as practicable, for experimental purposes in this country and in the *Bulletin* for June 1888, pp. 145–149, we gave a summary of information on the subject.

Recently the French Government undertook a series of trials of methods for preparing Ramie fibre, and in behalf of the India Office, Mr. D. Morris, F.L.S., the Assistant Director, was appointed to attend these trials and prepare a report of the results. This report, with the permission of the India Office, is reproduced below :—

Kew, October 24, 1888.

In the French *Journal Officiel* of the 13th of April last there appeared a ministerial order approving an International Competition

of Methods (mechanical and chemical) for preparing the fibre of the Ramie plant. The order was based on the fact that considerable interest was taken in the cultivation of the Ramie plant in Algeria and French Colonies generally, and that it was a matter of national importance to solve the problem of preparing Ramie fibre so as to bring it within the reach of commercial enterprise.

The competition was, in the first instance, fixed for the 15th August, but it was afterwards postponed to the 25th September on account of the unfavourable season which had been experienced for the growth of the Ramie plant intended to be used in the trials.

Importance of the Ramie Question.

It is well known that the production of the fibre of Ramie in commercial quantities, and in an economical and remunerative manner, has constituted one of the most important industrial problems of the present day. It has been keenly followed in nearly every part of the world; but the chief efforts hitherto made have been confined to India, to the West Indian Colonies, to the United States, and more recently to France and her Colonies.

The Government of India, nearly 20 years ago, was led to offer a reward of 5,000*l.* for the best method for preparing Ramie fibre and presenting it in a suitable condition for textile purposes. It was led to this step by the conviction that the only obstacle to the development in India of an extensive trade in Ramie fibre was the want of suitable means for decorticating the plant. This was the third time that Ramie had become the subject of official action. The first effort for utilising this plant was in 1803, when Dr. Roxburgh started the question; the second was in 1840, when attention was directed to it by Colonel Jenkins. The offer of 5,000*l.* in 1869 induced many competitors to enter their names, but it was found that no machine fully fulfilled the conditions laid down by the Government, and therefore the full prize was not awarded. Other unsuccessful attempts were subsequently made, and eventually the offer of 5,000*l.* was withdrawn.

Since that time many thousands of pounds have been spent upon the Ramie plant, and the aid has been invoked of both mechanical and chemical science to solve the problem connected with decorticating the fibre. Many processes have been brought forward from time to time, and it was claimed for each of them that they had fully realized the hopes of their inventors. But promising as some of these processes were, they do not appear to have been introduced into regular use, and only one or two have at all come into prominence.

Naturally the earlier attempts to prepare Ramie fibre had followed the methods already in use in preparing flax, hemp, and jute; but it was soon evident that as regards Ramie these methods were useless. The fact that the fibre of the Ramie plant is embedded in a gummy matter offered the greatest obstacle to the production of clean and bright threads suitable for the spinner.

Arrangements for Paris Trials.

The *Concours International de la Ramie*, recently held at Paris, took place in one of the annexes of the proposed exhibition of 1889 on the Quai d'Orsay (Place de l'Alma). It was attended by representatives from all parts of the world.

It was evident that the proceedings were watched with considerable interest by inventors, no less than by persons directly interested in the cultivation of the Ramie plant. Very complete arrangements had been made beforehand by the French Ministry of Agriculture. Steam power was provided and a large supply of green stems (of the species *Boehmeria nivea*) had been grown in the neighbourhood of Paris ready for the trials. Dried stems had been obtained from Algiers, while to test the chemical processes, a quantity of Ramie ribbons were available ready to be converted into filasse.

The commission of jurors included M. Tisserand, Councillor of State and Director of Agriculture, a number of prominent engineers, chemists and botanists (including the Professeur de Culture of the *Jardin des Plantes*), and the Director of Agriculture in Algiers. They were evidently men who were acquainted with the economical problems connected with the cultivation and utilization of the Ramie plant, and the trials were conducted in a systematic and exhaustive manner.

List of Prizes offered.

Prizes had been offered by the French Government in the following five categories:—(*a.*) For a machine to decorticate Ramie in a green state, driven by steam power, 1st prize 1,000 fr., 2nd prize 700 fr.; (*b.*) For a machine to decorticate Ramie in a dry state, driven by steam power, 1st prize 1,000 fr., 2nd prize 700 fr.; (*c.*) For a machine of a light and portable character driven by horse power, and suitable for use in the Colonies, 1st prize 700 fr., 2nd prize 500 fr.; (*d.*) For a hand-power machine of a light and portable character, suitable for use in the Colonies, 1st prize 500 fr., 2nd prize 300 fr.; (*e.*) For the best and most economical process (chemical or otherwise) to convert the Ramie ribbons into commercial filasse suitable for the use of textile manufacturors, 1st prize 1,000 fr., 2nd prize, 700 fr.

The entries previously made at the Ministry of Agriculture included 19 machines and 10 (chemical) processes. On the morning of the trials only four machines and one chemical process were submitted to the jurors.

The Delandtsheer Machine.

Taking the machines in the order in which they stood, the first was that invented by Delandtsheer of Paris (Décortiqueuse de Ramie Systême Delandtsheer). The cost was stated to be 40*l.* This was driven by steam power, and required two men to attend to it. It had a horizontal feed plate, and consisted of a series of rollers and crushers which received eight or ten stems at a time from the hands of the operator, and passed them on to be beaten by a pair of rapidly revolving drums very similar in character to those found in the Death machine. In the Delandtsheer machine, however, there is a reverse action attached of an effective character. When about five-sevenths of the lengths of the stems had been cleaned, they are quickly returned by means of the reverse action to the hands of the operator, who then presented the unclean ends to the machine and completed the operation. The fibre in this case was only moderately well-cleaned; there was considerable waste, and the actual amount of rather bruised ribbons was as follows: from dry stems, 5 kilos. per hour, and from green stems 18 kilos per hour. As the latter were weighed before they were dried, the calculations for dry ribbons would be about 6 kilos. If we take the result at 5½ kilos. per hour of dry ribbons, the Delandt-

sheer machine would produce only 55 kilos. per day of 10 hours, equal to about 120 pounds avoirdupois. The commercial value of these ribbons at 7*l.* per ton would be 7*s.* 6*d.*

The inventor claimed for the Delandtsheer machine that it could produce 3 cwt. of dry ribbons per day. The small out-turn at the trial was attributed by him to the poor character of the stems supplied. There was some cause for complaint on this head, but in any case it was difficult to believe that this machine could produce, as worked at Paris, ribbons in commercial quantity at a remunerative cost.

The Barbier Machine.

The second machine known as Barbier's (Décortiqueuse Armand pour la Ramie et toutes les plantes textiles : Constructeur Paul Barbier, Paris) was very similar in construction to the Delandtsheer machine already described. The cost was the same, viz., 40*l.* It was also fitted with a reverse action. The feed-plate was horizontal, and the operator handled about 8 to 10 stems at a time. The fibre was somewhat severely bruised in cleaning. In the first trial with dry stems it produced 3·6 kilos. per hour of ribbons. With green stems it produced only 7·5 kilos. in 47 minutes. There was a large amount of waste, and owing to the fibre being pushed backwards and forwards between the revolving beaters, the ends were often badly tangled.

It was claimed by the inventor that this machine could treat 2,500 kilos. of green stems per day of 10 hours, yielding 125 kilos. (presumably of dry) ribbons worth 50 francs per 100 kilos.

A machine illustrative of the Systême Lassalle (constructed by H. Chasles, Paris) was on the ground, but it was unable to compete in the trials. For the purpose of this report it may be passed without further notice.

Machine of American Fibre Company.

The next machine was exhibited by the American Fibre Company, of No. 18, Broadway, New York, under the charge of Mr. Noble. This was on an entirely different plan from any of the fibre machines hitherto in use, and deserves a few words of description. The machine was about 4 ft. 6 in. long and supported on standards about 5 ft. high. Above the machine was a wooden structure designed to receive the movable frames in which the stems were placed. The feeding was vertical from a frame containing about 30 stems placed above two wooden rollers working horizontally through the whole length of the machine. By means of a movable bottom in the feeding frame, the stems were dropped base-end downwards between the rollers which slightly crushed them. While firmly held in the machine, the stems were pressed against a horizontally moving knife, which split them along their whole length. After this they were bent in such a manner that the woody portions were fractured and separated from the fibrous cuticle. The latter was ultimately delivered in two ribbons, one on each side of the machine. In this instance all that was attempted was to separate the fibrous bark from the stems and deliver the former in broad ribbons, almost intact. No attempt was made to remove the corky epidermis or separate in any way the constituent fibres. This machine was worked by steam-power and required three men to attend to it. The cost was not given. It was tried on green stems only, and produced at the first trial 7 kilos. of wet ribbons in 18 minutes. At the second trial it produced 12·8 kilos. of wet ribbons in 38 minutes. These results would

be equivalent to 21 kilos. of wet ribbons per hour (or allowing one-third of the weight for dry ribbons) equal to about 15 pounds avoirdupois of dry ribbons per hour. It must, however, be borne in mind that the ribbons produced by this machine were simply the crude fibrous bark without any cleaning. The actual value of these ribbons would be very small; but if the machine had been capable of turning out half a ton, or even a quarter of a ton of such ribbons in a day, it would have possessed some value. The machine, as shown at Paris, it is needless to remark, was practically useless for commercial purposes.

The Royer Chemical Process.

The only chemical process for converting Ramie ribbons into filasse (or the beautifully white silky threads which Ramie is capable of yielding) for textile purposes was shown by M. Royer. This was described by the inventor as "Degommage de la Ramie Brute: Systême, E. Royer, "Paris. Le traitement industriel complet de la Ramie Brute par ce "Systême constitue une dépense de 10 a 12 fr. par 100 kilos de matiére "brute." The details of the process were not made known. The ribbons were laid horizontally in small portable wooden crates, and submitted to the action of certain chemicals in successive baths. Afterwards they were placed in an iron cylinder or closely fitting steam chest and thoroughly exposed to the solvent power of steam at high pressure. The filasse produced was beautifully white in some cases, but in others it was mixed with portions of bark and discoloured. The system appeared to be laborious and costly. The jury was unable to arrive at a satisfactory conclusion as regards the merits of the process during the session of the trials between the 25th and the 30th September, but the general opinion of those present was not favourable to the process.

The actual trials commenced on the 26th September and closed on the 30th. The first day was devoted to trials with dry Ramie stems, the second to green Ramie stems, while the third was chiefly devoted to the chemical process for converting ribbons into fibre. On the fourth day the jury carefully examined the construction of the machines, tested by a dynomometer the powers necessary to drive each one, and in some instances retried the machines in order to correct or confirm the results already obtained.

Awards of the Jury.

As regards the awards of the jury, in a letter received from the Foreign Office dated the 12th inst. enclosing a despatch from the English Embassy, at Paris, it is stated that "since the International "competition for machinery for, and methods of, decorticating Rhea "was held, the question of distributing prizes was duly taken into "consideration. But according to the information conveyed to the "Embassy by the French Ministry of Agriculture none of the advertised "prizes were given, the jury having only made the following awards, "viz.:—600 francs to Mr. Delandtsheer, 2, Place des Batignolles, "Paris; 400 francs each to the Compagnie Américane des fibres, "18, Broadway, New York, and to Mr. Armand, whose machine "was exhibited by Mr. Barbier, 46, Boulevard Richard Lenoir, Paris.

"No report on the subject of the competition will be published in the "*Bulletin de l'Agriculture* before the issue of the November number "of that periodical."

These are, briefly stated, the results of the Paris trials on Ramie. That the results are unsatisfactory and disappointing, and fall far short of the estimates of the inventors, there can be no matter of doubt. It is probable that a fresh series of trials will be inaugurated next year in connexion with the Paris Exhibition of 1889 ; and if the value of the prizes is increased there will doubtless appear a larger and better representation of machines and processes.

The Favier System.

It will be noticed that there was no trial this year of the Favier system which is in operation in Spain, and is described in the *Kew Bulletin* for June 1888, pp. 145-149. Nor was there a trial of the Death machine (constructed by Death and Ellwood of Leicester), which has been in use, experimently, in many parts of the world. The Favier process is being worked privately, and is therefore not available to the public. The fibre hitherto produced has been exclusively used in France ; but the quantity so far available has not been sufficient to base an opinion as to the permanency of the enterprise. M. Favier, who has long taken a deep interest in the Ramie fibre, was a member of the jury at the Paris trials, and the articles which he has contributed on the subject to the *Journal l'Industrie Progressive* of October 7 *et seq.*, may be looked upon as embodying the views of one of the best informed of French experts on the present position of the Ramie question.

The Treatment of Dry as against Green Ramie Stems.

Amongst the French there is attached an importance beyond their value to machines for cleaning Ramie in the dry state. This has arisen partly, no doubt from the fact that the Favier system, the only one which hitherto has obtained a measure of success, requires the stems to be dried before they are treated. An idea was also prevalent in France that in some parts of the country it might be possible for the farmers to grow one or two crops of Ramie, and cut and harvest the stems in summer and work them off at their leisure during the winter. If a machine were devised to treat Ramie successfully, it is improbable that France could compete with tropical and sub-tropical countries, where three or four crops of stems could be reaped in the year. This conclusion is now being gradually adopted in France, and the future exploitation of Ramie is treated as a question which more nearly concerns Algiers and the French tropical Colonies.

As regards India and our own Colonies, it is essential that Ramie machines should work upon the green stems, and not upon the dry. In the rainy season, when the air is impregnated with moisture, to dry Ramie stems in the open year after cutting would be an impossibility. To attempt to dry by artificial means the enormous quantity of stems yielded even by a few acres would entail so much labour in handling, and so much expense for buildings and fuel that it would be altogether a hopeless task.

The per-centage of crude fibre yielded by Ramie stems is estimated at about 10 per cent. If the stems must be first dried before they are treated, it would be necessary to handle, to cart in and cart out again from drying sheds, 100 tons of stems for every 10 tons of fibre produced. It might be suggested that harvesting the stems should take place in the dry season, when the conditions would be most favourable to drying them in the open air.

This unfortunately would not be practicable. The stems grow best during the rainy season, and when once ripe they must be cut at once. Besides, it is evident that the sooner one crop is removed the better will be the prospects of the next. During the dry season the stems grow very slowly, and it has been noticed that such stems have short internodes, are very woody, and offer relatively greater resistance to the process of decortication.

Other Processes and Machines.

Of processes and machines not already mentioned, it is desirable to refer to one or two for the information of persons who may not otherwise become aware of them. In June of last year Mr. C. Maries, of Durbhungah, Bengal, forwarded a series of specimens of Ramie fibre in different states of preparation to Kew and asked for an opinion upon them. It appeared that he had invented a machine, worked by two men in the field, capable of operating upon two to three hundred stems per hour. This machine simply separated the fibrous bark from the wood. The bark was then operated upon by other processes and eventually it was deprived of gum and mucilage and worked into a tolerable fair fibre suitable for manipulation by textile manufacturers. This fibre was reported by Messrs. Ide and Christie as "long, fairly cleaned "Ramie fibre worth about 28*l.* per ton." The particulars of Mr. Maries's methods have not been made public; but we understand that a well-known firm of merchants in Calcutta has acquired the patent connected with them, and the system is now in course of being practically teste on a large scale.

In the columns of the *Times* there recently appeared an account o a machine invented by Mr. John Orr Wallace, and placed on view at the Irish Exhibition. This was termed a "patent scutching machine "for cleaning ramie, flax, hemp, &c." The apparatus is about 6 ft. high by 4 ft. wide, and 5 ft. long. It consists of an upper feed table 36 inches wide, on which the stems are fed to three pairs of fluted rollers, which deliver the stems downwards between five pairs of pinning tools, alternating with six pairs of guide rollers. The pinning tools somewhat resemble hand-hackles, and may be popularly described as very course wire brushes. They are attached to two vertical frames to which a horizontal to-and-fro motion is imparted, and the pins interlace as the two sides approach. The fibrous material is drawn downwards by rollers which have an intermittent motion, and at each momentary pause, the pricking pins enter the material and are rapidly withdrawn from it. By degrees this fibrous-descending curtain is delivered on to a sloping receiving table at the bottom of the machine, over which table the woody substance has previously passed to a receiver in a crushed and semi-pulverized condition, and perfectly free from fibre. This machine, it may be mentioned, was not constructed for the special treatment of Ramie. In spite of this, however, it has cleaned Ramie in a fairly satisfactory manner, and the inventor claims that, with a few necessary alterations in detail, he will be able to treat the stems either green or dry and produce clean fibre at the rate of 1 cwt. per hour. The machine can be driven by a two-horse power engine, and it requires two persons to feed and tend it.

Small quantities of Ramie stems grown at Kew have been successfully passed through the machine. It is proposed by the inventor, when he has completed the alterations, to submit this machine to a public test similar to that adopted at the Paris trials. For this purpose

he states that a large supply of Ramie stems will be obtained from France.

There are some special advantages connected with this machine which deserve to be mentioned. In the first place the feed table is so large that at least 40 stems can be fed to the rollers at once. When the stems have been fully grasped by the rollers, the operator need not retain his hold upon them any longer. They pass on uninterruptedly through the machine, and they can be followed immediately by a fresh lot without the return action, which is an essential part of the treatment by the Death and the Delandtsheer machines. There is here a considerable saving in time, and there is also a complete absence of the rough usage to which the fibre is subjected in nearly all the purely mechanical processes which have hitherto come under my notice.

Personally, I am unable to express an opinion upon the Wallace machine. To say that it is more promising than any machine exhibited at the Paris trials is merely to affirm that it is not altogether a failure. When the machine is fairly tested on its merits, and it is worked continuously on large quantities of Ramie stems, the results will speak for themselves. Until that is done it is obviously undesirable to do more than draw attention to a machine which possesses considerable merit and which, with further improvements, may be rendered of service in the production of fair marketable fibre.

General Conclusions.

An eminent firm of brokers recently informed me: "There is no "doubt that Ramie is exciting great interest in many parts of the world, "and many people are experimenting with various processes for extracting "the fibre cheaply and quickly. We cannot say that any results sub- "mitted to us up to the present time are quite satisfactory. The fibre "is either imperfectly freed from gummy matter, or the process breaks "down in the matter of cost or owing to the local conditions under "which it must be carried on. We consider that no system of "preparation which cannot produce the clean, unbleached fibre under "30*l.* per ton is likely to succeed in establishing this article firmly "in the estimation of English textile manufacturers."

This opinion expresses very briefly and clearly the conclusion at which I have arrived in connexion with the preparation of Ramie fibre. It is quite possible that some machine or process will eventually solve the problem, but at present the exploitation of Ramie, in spite of years of labour and the expenditure of large sums of money upon it, cannot be said to have yet emerged from the experimental stage.

D. Morris.